DEPARTMENT OF AGRICULTURE, BENGAL

ANNUAL REPORT

OF THE

KALIMPONG DEMONSTRATION FARM

FOR THE

YEAR 1910-1911.

CALCUTTA:

THE BENGAL SECRETARIAT BOOK DEPÔT.

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[*Price—Indian, 4 annas; English, 5d.*]

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INTRODUCTION TO KALIMPONG DEMONSTRATION FARM.

In conjunction with the St. Andrew's Colonial Homes at Kalimpong the Bengal Government opened a Demonstration Farm at Kalimpong in April 1907 for the district of Darjeeling. The agricultural practices of this part of the Himalayas in the Bengal district of Darjeeling will now be tested and definite figures of the cost of cultivation of the chief crops of this tract with outturns per acre will be worked out.

The geological formation of this station in the extra-peninsular area, which is not represented on any of our other present agricultural stations in Bengal, is the Daling series of transition rocks. From analyses we find that in the hills we are dealing with soils totally different in composition to those of the plains of Bengal, where organic matter is very deficient in all cultivated areas.

The normal rainfall of the Kalimpong district is about 90 inches. Such heavy rainfall can only be supported by certain crops, because of the rapidity with which the water drains off these slopes, and it is very remarkable that the maize crop thrives so well as it does, for it reaches a maximum that is seldom approached on the plains. Waterlogging kills the maize plant, and one can only admire the provision of nature that facilitates the immediate drainage of the surplus water. On the other hand, for the paddy crop which delights in plenty of water, each terrace is embanked by little bunds to cause accumulation. The winter months from November to March are very dry and there is not sufficient natural moisture to ensure full crops. Accordingly potatoes and vegetables and *rabi* crops must be watered or irrigated if large crops are required.

Although the work at this station has not been carried on very long, there are already some interesting results to record. Jaunpur maize, which has given such excellent results on the plains, is quite unsuitable for the hills. This variety failed entirely in 1907 and 1908 when the local variety did exceptionally well.

The following interesting results have been obtained :—

A. *Local maize.*—33 maunds 15 seers per acre. Grown on terraces—unmanured, and ·77 acre in area; stalks not given.

B Buckwheat.— { 12 maunds grain / 27 „ straw } per acre.

C. *Juar.*— { 11 mds. 24 seers grain per acre. / Straw not given.

D. *Wheat.*— { 8¼ maunds per acre. / Straw 17 mds.

E. *Paddy.*— { 20½ maunds grain per acre. / 30⅛ „ straw.

F. The Horatius cornsheller (Montgomery Ward) has given satisfactory results. (T. E. Thomson & Co., Calcutta, Rs. 6.)

Shells—5 maunds of grains per hour.

9½ maunds grain from 20 maunds of cobs (with leaves round cobs).

In 1909 an outturn of 37¼ maunds of maize per acre was obtained.

In addition to ordinary crops a thorough test will be made with English fruit trees to find out their suitability for the Kalimpong hills, and seedlings of the most important trees have been obtained from the Royal Nurseries, Maidstone, England. These will be properly treated and their progress carefully recorded year by year.

Mr. P. Goodwin, Superintendent in charge of the Farm, has written the following report

G. Sherrard,
Deputy Director of Agriculture, Bengal.

ANNUAL REPORT OF THE DEMONSTRATION FARM, ST. ANDREW'S COLONIAL HOMES, KALIMPONG, FOR THE YEAR 1910-11.

Situation and History.—The village of Kalimpong is the headquarters of the subdivision of Daling (a Government estate of 401 square miles). The district was taken from Bhutan by the British Government after the Bhutanese war of 1864-65. The settlement of the estate restricts the ownership of land to hill tribes, and at the same time makes provisions by which Lepchas and Bhutias are only allowed to dispose of their land among themselves. This condition was introduced to prevent the more thrifty and enterprising Nepalese from becoming possessors of all the land in the district, which would to a great extent have been the case had no steps been taken to prevent it.

All transfers of land go through the khas mahal office, and an annual ground rent of from Re. 0-6 to Re. 1-4 is charged by Government.

Kalimpong has a fairly large bazar, and is the mart for the produce of a considerably large area, in addition to which it is the centre of Tibetan trade with Bengal.

It is 38 miles from Siliguri station (Eastern Bengal State Railway) and 28 miles from Darjeeling; Ghoom station (Darjeeling Himalayan Railway) being four miles nearer.

The Demonstration Farm is situated below the bazar on the easterly slope which runs down to the Rilli River, a tributary of the Tista joining the latter at Riang.

Although about 24 acres of land had been cultivated by the Homes prior to April 1907, the remaining portion was not taken over from the native cultivators until December of that year, after the crops were harvested. On the former portion maize had been planted, with the exception of that part under rice terraces, and although a few experiments were commenced in 1907, it was not until the beginning of 1908 that a proper start could be made.

The land was formerly under cultivation by the various natives who owned it, but a lot of preliminary work had to be undertaken before much of it could be used for experimental work. Many of the best plots of land were useless for definite and accurate work owing to their having trees, bamboo clumps, houses, etc., on them.

These have been gradually removed, coolies' houses erected in more suitable places, and bamboos planted on places near the *jhoras* likely to suffer through slips. On the top boundary of the farm adjoining the public road and the bazar common land barbed wire fences have been put up, at an initial cost of Rs. 106-12, and hedges planted. Sixty-nine boundary pillars have also been built at a total cost of Rs. 106-9. The total amount spent in making roads, including a cart road from the lower end of the farm to the top, where it joins the khas mahal road, and small bridle paths where necessary, was Rs. 359-13.

This preparatory work, the erection of the farm buildings, and the cultivation of the ordinary crops occupied much of the first two years. Some experiments were carried out, chiefly with juar, maize, rice and jute, of which mention will be made under their respective headings.

Area, elevation, etc.—A survey of the farm with level section was made in February, March and April 1911, at a cost of Rs. 136-0-6. The plots were all numbered and the areas computed. The total area, exclusive of jhoras, is 60·78 acres, of which 9·54 are occupied with roads, houses, buildings, waste ground and land under trees and bamboos, leaving 51·24 acres of land for cultivation.

During the year under report 24·17 acres were under experimental cultivation as compared with 22·22 in 1909-10. Detailed records of time of sowing, amount of seed, date and cost of each part of cultivation, time and cost of harvesting, weight and value of outturn, etc., of the crops from these 24·17 acres were kept in the cultivation book under 55 separate accounts. The remainder of the land, viz. 27·07 acres, was partly cultivated under the ordinary crops, and partly given to the farm coolies on the half-crop system.

The whole cultivated area of 51·24 acres is divided into 69 plots, for the most part irregular in shape, and varying in size from small fractions of an acre to over three acres.

The elevation of the farm is as shown below :—

	Feet.
Lower boundary	3,317
Buildings	3,693
Upper boundary	3,864

The level section taken through the farm from top to bottom shows an average gradient of 1 in 5. The slope is therefore a very moderate one, and the hillside on which the farm is situated is certainly one of the best and most thoroughly cultivated in this part of the Himalayas, so that a better situation for an experimental farm could hardly be procured.

While the elevation approaches the upper limit for the cultivation of rice and *dal*, quite good outturns are nevertheless obtained, while for maize, *kodo*, soy beans, buckwheat, etc., the situation is excellent. A few hundred feet in elevation makes a considerable difference in the outturn of crops, some increasing, others decreasing as greater heights are reached. But with most of the ordinary hill crops satisfactory results are obtained at about the elevation of this farm.

Soil, etc.—The results of the analyses of soil and sub-soil of this farm, as made by Mr. Annett, Officiating Imperial Agricultural Chemist, which were given in last year's report, are again reproduced:—

	295—09. Soil.	296—09 Sub-soil.
Insoluble silicates and sand ...	69·47	71·29
Organic* matter	8·06	6·51
Iron oxide (Fe_2O_3)	6·36	6·42
Alumina (Al_2O_3)	11·91	11·98
Phosphoric acid (P_2O_5)	·21	·12
Lime (CaO)	·16	·10
Magnesia (MgO)	·68	1·00
Potash (K_2O) / Soda (Na_2O)	·89	·76
Carbonic acid (CO_2)	·01	·06
Undetermined	2·25	1·76
	100·00	100·00
* Containing nitrogen	·21	·12
Available phosphoric acid	·017	·007
„ potash...	·028	·012

"The soil is remarkable in that its reaction is acid. It is badly in need of dressings of lime. I should be interested to know what crops, if any, have been grown on this land and what sort of yield they give."

The quality of the soil has become much more uniform in the four years during which the farm has been working, but it is still variable. This is one of the greatest difficulties one has to contend with in conducting experiments on hill land. It is practically impossible to obtain two or three plots of any size similar in character. Where some of the land happens to be more steep than the rest, the washing

of the finer particles of the soil into the depressions, or more often into the jhoras, which is continually going on when heavy rain falls, is much greater, and although more manure may be applied to the steeper parts to bring them up to the same state of fertility, the effect is only temporary in many cases, and the growing of experimental crops on two plots side by side, each receiving the same quantity of manure, and similar cultivation, is bound to result in the steeper one (and both plots can very seldom be got quite uniform in slope) giving a smaller outturn than the other, providing the sub soil is of similar character. It has been shown by experiments in England and elsewhere that plots of practically uniform land on the level show variable outturns year by year, and it is evident that there will be a greater variation from one year to another on hill land. Moreover, two plots side by side which have a sufficiently gradual slope to partly arrest the flow of water coming from steeper land above, and cause deposition of sediment, may be differently affected according to the character of the land above each plot from which sediment is washed. According to its position or method of cultivation the sediment deposited on each plot may be widely different in fertilizing value. Again on rice terraces dissimilarity may follow as the result of irrigation. Ordinarily the terraces are irrigated from both sides, and it is obvious that the water coming a short distance from a spring on one side may have very different effects from that out of a jhora on the other side, which may receive water containing bazar refuse or flowing from the neighbourhood of slaughter-houses, etc.

Taking these facts into consideration, the obvious conclusion is that to obtain accurate and definite results from any experiments, it is essential that they be continued for a number of years. On level land from the results of two or three trials reliable conclusions may be drawn, but these would not suffice on hill land, unless there is a very striking difference between two varieties of a crop, and a manurial experiment, conducted for a couple of years only, might quite possibly show results contradictory to the conclusions one arrives at by careful observation, or what might be expected from the tests conducted in other places. It is impossible to overestimate the value of observation in the conduct of agricultural experiments, although accurate measurings and weighings must be made and careful supervision exercised during the period of cultivation, in order to be able to publish results.

It is often urged on farmers in general who are endeavouring to find out what manures are best suited to their own land for any

particular crop that they should measure off the plot of ground and carefully weigh the produce therefrom. It would be well to remember, however, that with the exception of the more soluble nitrogenous manures, the effects of most manures are felt for several years, and certainly in calculating the economic results of applying a special manure to any one crop, some notice must be taken of the effect on the succeeding ones Moreover, without absolute accuracy an experimental record is useless, and to ensure that this accuracy is obtained, great care and attention is required, which means not only extra expense, but also a considerable amount of time, which a farmer can perhaps ill afford to spare at that particular season.

An intelligent and observant cultivator will, as a rule, be able without actual measuring and weighing to tell whether his outlay on a particular manure is justified by the enhanced value of the produce.

Meteorology.—The following table shows the normal rainfall (*i.e*, the average of eleven years) at the Charteris Hospital, Kalimpong (about half a mile from the farm), compared with the fall for 1910-11. The actual rainfall at the farm has only been recorded since the middle of May 1909, and is given in this table from June of that year :—

Month.	Charteris Hospital.						Demonstration Farm.			
	Normal rainfall average of eleven years 1900—10.		Rainfall for 1909-10.		Rainfall for 1910-11.		Rainfall for 1909-10.		Rainfall for 1910-11.	
	Inches.	Rainy days.	Inches.	Rainy days.	Inches.	Rainy days.	Inches.	Rainy days.	Inches.	Rainy days.
April ...	2·23	8	4·34	14	2·57	11	...	...	3·06	12
May ...	5·08	16	5·67	12	4·88	15	...	...	5·78	18
June ...	16·20	22	23 74	23	15 13	18	25·48	25	17·65	19
July ...	23·59	25	25·27	27	29·97	27	29·46	28	31·76	28
August ...	19·57	25	20 30	25	14·45	23	22·36	26	16·76	25
September ...	11·40	18	9·12	18	13·88	20	9·84	20	16·40	22
October ...	3·05	5	5·53	6	5·74	7	5·43	6	6 51	8
November ...	·30	1	·02	1	...	...	·01	1	...	...
December ...	·34	1	·22	3	...	...	·21	3	...	...
January ...	·35	2	·15	2	·80	2	·06	2	1·04	2
February ...	·60	3	·17	1	·35	3	·18	2	·53	4
March ...	1·52	5	2·33	7	1·77	5	3 22	8	2 18	5
Total ...	84·23	131	96·76	139	89·54	131	96·25	121	101·67	143
April 1911 ...	...	...	...	...	2·72	8	...	...	3·40	13
May ,, ...	...	...	...	...	10·52	21	...	...	12·82	24
June ,, ...	...		...	...	22·41	22	...	...	24·73	21
Total ...	...	...	...	...	35·65	51	...	...	40·95	58

In last year's report the total rainfall was reckoned from July to June, but in doing this, comparisons cannot be correctly made. Maize

is sown at the end of March and the beginning of April, and all crops, with perhaps the exception of a little wheat or barley, are got in before the end of March. To enable one to compare the effects of the year's rain on the crops of a complete season, the totals should therefore be calculated from April to March, and this plan has been followed in this report. The fall for April, May and June 1911, for example, has practically no effect on any of the crops given in the year 1910-11, because the end of the cropping year is practically the end of March.

The rainfall at the farm has only been registered since the middle of May 1909, so that any peculiarities during the year under report must be looked for under the hospital record.

The table is very interesting in showing the great local variation of rainfall in the hills owing to the effect of direction or extent of slope or altitude on the currents.

The farm shows an excess fall over the Charteris Hospital of 9·50 inches with seven more rainy days in ten months, June to March 1909-10 and 12·13 inches with 12 extra days on which rain fell, for the year April to March 1910-11. Looking at the hospital record it will be seen that the year under report shows an excess of rainfall over the normal of about $5\frac{1}{4}$ inches compared with $12\frac{1}{2}$ inches in 1909-10.

The season was on the whole rather more favourable for the maize crop, but very much against rice; the poor rainfall in June 1910 being to a great extent responsible, though the lower temperature of the year 1910 had a considerably bad effect on the crop at this rather high elevation.

The heavy fall during May and June 1911 is noteworthy, being during these two months $11\frac{1}{2}$ inches in excess of the normal. This has been taken advantage of, and the planting of the rice crop is very much earlier than usual.

Buildings.—The following description and information is taken from last year's report:—

"The new buildings were completed and occupied in August and September 1908. The godown is a two-storied building having two rooms below, each $25 \times 20\frac{3}{4}'$ with cemented floor, and one room $52' \times 21\frac{1}{4}'$ above. One of the lower rooms is partitioned off along one side into six wooden cubicles for storing grain, and there are ten galvanised iron seed bins. The upper room is fitted with a large cupboard for small tools, and shelves for seed-boxes, etc.

There is a small lean-to tool shed by the godown for tools in daily use. The byre will hold eight pairs of bullocks which stand tail to tail

with a 5-foot passage down the centre. It is 32 feet long by 21 feet wide. The width of each stall for one pair of bullocks is 8 feet, and the depth is also 8 feet, of which about 18 inches are taken up by the earthenware trough. The floor except the passage (which is of stone and cement) is made of sleeper ends set in with pitch, which provides very comfortable and warm lying for the bullocks. The drainage from the byre runs into the *manure pits*, which are three in number, each 22 feet by 12 feet and 5 feet 4 inches deep with cemented floor and walls. The roof is supported on pillars 5 feet above the walls. Water is laid on to the yard by pipes from a spring higher up.

The following shows the cost of each part of the work :—

	Rs.	A.	P.
Godown	3,590	0	9
Manure pits	2,009	15	3
Byre	1,559	14	6
Water-supply	127	6	0
Cutting site and levelling yard ...	470	12	3
Dry stone embankment	434	13	6
Drains	50	0	0
Total ...	8,242	14	3

Of this sum, Rs. 7,000 were given by Government, the Homes supplying the balance of Rs. 1,242-14-3. A rice-hulling machine with house of bamboo and thatch was put up in January 1910 at a cost of Rs. 20-12

Terracing.—To compare the results of growing the ordinary crops (not irrigated rice) on terraced and on unterraced land, one acre was terraced in 1908 at a cost of Rs. 96-3-6, a further sum of Rs. 11-2 being expended in improving the terraces in February 1910. A second acre of unterraced land adjoining this was measured off. The two plots were formerly as uniform as it is possible to get, the slope being a fairly gradual one. Each plot receives similar treatment ; equal amounts of manure and seed are applied to each, and when possible the crops are planted on the same day. The cost of the labour varies, of course, to some extent.

The results of the experiments for the two years are given :—

1909-10.

	Terraced acre. Out-turn. Mds. s.	Terraced acre. Cost of cultivation. Rs. A. P.		Unterraced acre. Out-turn. Mds. s.	Unterraced acre. Cost of cultivation. Rs. A. P.
Crop—			Crop—		
Maize ...	.....	27 10 9	Maize ...	.....	33 11 9
Grain ...	20 36	.....	Grain ...	30 17	.....
Straw ...	97 32	.....	Straw ...	143 36	.....
Buckwheat—	.....	16 14 6	Buckwheat—	.....	20 0 0
Grain ...	5 15	.....	Grain ...	10 0	.....
Straw ...	18 14	.....	Straw ...	31 34	.....

1910-11.

	Terraced acre.		Unterraced acre.	
	Out-turn.	Cost of cultivation.	Out-turn.	Cost of cultivation.
	Mds. s.	Rs A. P.	Mds. s.	Rs. A. P
Maize—	.....	28 2 9	.....	32 15 0
Grain ...	22 21	.....	31 28	.....
Dâl— ...	.....	22 6 6	.....	23 4 0
Grain ...	6 38	.....	5 10	.....
Straw ...	6 16	.....	5 20	.....

It will be seen that the outturns of both crops in the first year are much bigger on the unterraced plot, and also in the case of maize, the second year. The *dâl*, however, gave a considerably higher outturn on the terraced acre. This is to be expected when it is remembered that *dâl*, being a leguminous crop, chiefly requires mineral foods, a fresh store of which is naturally brought into use by the exposure of the sub-soil on the inner parts of the terraces. Owing to wash on the terraced plot after the sowing of the *dâl*, it did not come up very evenly and to some extent suffered from subsequent heavy rains. The lower cost of cultivation on the terraced acre is accounted for, partly by less expense being incurred in harvesting and threshing a smaller crop, and partly by the fact that fewer weeds grow on the inner halves of the terraces during the first few years.

The experiment should be carried on for a number of years to find out if the expense of terracing is justified by the greater value of the produce, say in 10 or 15 years. Terracing diminishes the surface area of the land considerably, owing to the terraces having sloping banks. At the same time it minimizes the loss of valuable ingredients by heavy rains, and the application of manure is more likely to be successful. This experiment will be a very interesting one and should give valuable results.

Implements.—The Lakeside Fanning Mill ($ 11·50 Chicago) has been a very useful machine for winnowing all kinds of grain. The work is done very much more quickly than by hand methods, and a better sample of corn is obtained.

Two hundred and ninety maunds of maize were put through the Fan in five hours by nine hands (18th March 1910). For winnowing rice, this machine is very successful. The method employed locally is a slow process, a short description of which is here given. After the rice has been threshed out by making sheaves and beating them on th

ground, the straw is well trampled by bullocks and then removed and the grain is collected into a heap; a place on the threshing floor which has previously been plastered with cowdung is then swept clean with wisps of straw, and one man takes up a little of the grain from the heap in a round tray or *nanglo* and spreads it thinly over the ground. Three or four other hands then blow out the chaff and dust by fanning it with trays, while any stones or heavy rubbish that may be present have to be picked out by hand. The new heap gradually becomes conical in shape and each trayful is dropped round the apex and falls in a thin layer towards the base. A local method of ascertaining the weight of rice in the heap is to measure round the base and calculate at the rate of 8 inches per 1½ maunds. This will of course vary according to the weight of the rice per bushel, but I have found that it gives a very close approximation to the actual weight. The above process of winnowing is a tedious one, and the advantage of using a machine is shown by the following figures:—

	Mds.	s.
With Lakeside Fanning Mill—		
Three hands cleaned in half an hour ...	18	2
By ordinary method—		
Four hands cleaned in half an hour ...	8	33

Wheat, buckwheat, *dâl*, *bhatmas*, etc., are usually winnowed with *nanglos*, each coolie taking up a little and blowing out the chaff and dust by rapid movements of the *nanglos*. This work requires no little dexterity and is usually done by the women. For *kodo* a special kind of *nanglo* is used, which has meshes, through which the small grains fall. The employment of a machine has resulted in the saving of much time in winnowing all these different kinds of corn.

The Lakeside machine is rather small and not too strongly made; it is very cheap, but I would recommend any one who intends to go in for a fanning machine to get a larger and more strongly built winnower. The extra cost would be more than repaid by the faster and more efficient work and the machine would with proper use last for a long time. With a good model, too, there is no reason why machines should not be made locally Most of the fittings could very easily be made by the village blacksmith, while others, such as the cogged wheels, could be procured in any large town.

Horatius Corn Sheller ($1·50 Chicago). For extracting the grain from maize cobs these machines have proved a great boon. They are very simple and easily worked The best method of hand-shelling is by stripping off the grain with the backs of sickle blades. A comparison of the two methods is here given—

	Mds.	s.
With Horatius Corn Sheller—		
Four hands shelled in half an hour ...	2	20
With sickles—		
Four hands shelled in half an hour ...	1	35

Another maize shelling machine known as the "Black Hawk" has been procured from Messrs. T. E. Thomson's, but has not yet been tried.

Rice huller.—The local implement (called a *dhiki*) is made by fixing two strong wooden posts in the ground and fastening between them a long beam with a pivot attached 2 feet from one end and 7 feet from the other. About 18 inches from the longer end, on the underside, a small block of wood, about a foot long, tipped with an iron ring, is fixed into the beam. This plug fits into a hole 6 inches deep made in a large stone on the floor of the house. The floor round the stone is made concave and plastered, and the rice to be husked is placed in this. Two coolies are required to work the beam with their feet, and one keeps the rice under the plug and fans out the husk as it is finished.

The cost of preparing the husked rice (*chawal*) from one maund of *dhan* is about four annas, three hands being usually able to husk about three maunds per day. When other farm work is slack, coolies may be profitably employed in husking rice. A profit of about two annas per maund may be reasonably expected.

Cahoon seeder.—This implement, which is carried on the back, has not been found workable on the hill slopes, but it could be used with advantage on level land.

Crops.—The following table shows the area cultivated under different crops in 1910-11 with the total and average outturns and the produce derived from the land let out on the half-crop system :—

Name of crop.	Acreage.	Outturn.	Outturn per acre.	Half crop.	Total.
		Mds. s.	Mds. s.	Mds. s.	Mds. s.
Maize ...	19·70	544 19	27 25	74 18	618 37
Rice—					
Grain ...	10·63	185 33	17 19	61 24	247 17
Straw ...	...	368 4	34 24	66 37	435 1
Kodo ...	1·14	29 23	25 38	30 31	60 14
Buckwheat—					
Grain ...	·90	7 15	8 5	...	7 15
Straw ...	...	28 25	31 32	...	28 25
Wheat—					
Grain ...	2·00	8 4	4 2	...	8 4
Straw ...	...	21 33	10 36	...	21 33
Barley—					
Grain ...	·50	3 8	6 16	...	3 8
Straw ...	...	7 3	14 6	...	7 3
Uwa—					
Grain ...	·25	0 14	1 16	...	0 14
Straw ...	....	3 36	15 24	...	3 36
Dâl—					
Grain ...	2·62	15 30	6 0	1 6	16 36
Straw ...	...	16 12	6 9	...	16 12
Dâl—					
Grain ...	10·63	7 38	0 30	...	7 38*
Straw ...	...	9 30	0 35	...	9 30*
Mūngi dâl—					
Grain ...	·38	2 14	6 7	...	2 14
Straw ...	...	2 35	6 36	...	2 35
Soy bean—					
Grain ...	1·56	22 34	14 26	0 36	23 30
Straw ...	...	27 2	17 13	...	27 2
Soy bean—					
Grain ...	·25	0 26	2 24	...	0 26†
Straw ...	...	0 20	2 0	...	0 20†
Mashyem—					
Grain ...	1·00	8 26	8 26	...	8 26
Straw ...	...	10 18	10 18	...	10 18
Gahat—					
Grain ...	·29	1 10	4 12	0 6	1 16
Straw ...	...	1 12	4 19	...	1 12
Gurans—					
Grain ...	·22	2 28	12 11	...	2 28‡
Straw ...	...	2 0	9 3	...	2 0‡
Juar ...	·50	5 7	10 14	...	5 7
Thatching grass.	1·32	107 0	81 2	...	107 0
Oats—					
Grain ...	·25	1 4	4 16	...	1 4
Straw ...	...	16 0	64 0	...	16 0

* Grown on banks of rice terraces. † Nepali bhatma.
‡ A variety of mashyem.

Name of crop.	Acreage.	Outturn.	Outturn per acre.	Half crop.	Total.
		Mds. s.	Mds. s.		Mds. s.
Gram—					
Grain ..	·50	0 12	0 24	...	0 12
Straw ...	...	1 8	2 16	...	1 8
Mustard—					
Grain ...	·25	0 13	1 12	...	0 13
Straw ...	...	0 22	2 4	...	0 22
Sugarcane ...	·07	92 33	618 33	...	92 33
Ghaiya—					
Grain ...	·25	6 2	24 8	...	6 2*
Straw ...	...	68 0	272 0	...	68 0
Pineapples ...	·15	340 pines	2,266 pines	...	340 pines not weighed.

* Straw weighed green.

Maize, rice and *kodo* are the three crops most extensively cultivated in this district. Maize occupies most of the unterraced cultivated land with the exception of small plots of unirrigated rice (*ghaiya*), sugarcane, fruit trees, etc. As a secondary crop after maize, *kodo* takes chief place, other crops being *dâl*, Soy bean, buckwheat, wheat, barley, mustard, etc. After rice as a rule no crop is grown. Small patches of wheat are sometimes seen when water is available for ploughing. At this time of the year (December) it is not possible to plough the terraces unless irrigation is previously resorted to, and except in a few favoured places water is not available. At lower elevations maize is grown on the rice terraces, chiefly for fodder, though near the valleys of the Tista and Rilli the maize ripens sufficiently early to allow of the cobs being sold green in the bazars without causing delay in the planting of rice. On the banks of terraces (*alis*) *dâl* and Soy beans are usually dibbled in. Detailed records of 55 experiments have been this year kept in the cultivation book.

Zea Mays—Maize—*Makai, bhutta.*

The year under review was a much better one for this crop than the previous season. All the maize on the farm was sown from 14th March to 6th April, except one-half acre plot which was sown on 28th April, while harvesting took place from 24th August to 12th September. Twenty-five seers of seed were sown per acre broadcast and the plants subsequently thinned out. Less seed would probably suffice, but the cost of a few extra seers is very little and a good plant may be expected. It should be remembered that

caterpillars do considerable damage to the young plants in dry weather by eating through the base of the stem, so that a crop is often thus considerably thinned before the first hoeing takes place After this the maize plants usually grow very fast, and unless very dry weather ensues are soon beyond the stage when caterpillars can do much harm. The maize seed was very carefully picked out, the best grains being taken from the best cobs ; its germinating capacity was practically 100 per cent. By this selection of seed the cobs have become much more true to colour and type. The much larger crop obtained this year was probably due to the seed selection to a very large extent. At harvest time as soon as the cobs are brought in the outer leaves are taken off, and the inner ones, which are always comparatively dry, are left on for protection ; the cobs are then tied in bunches of about six by means of the leaves and stacked outside on bamboo *machâns* ; any very small or damaged cobs being stored in the granary. By this method the grain keeps excellently, is safe from rats and mice and is very little hurt by the depredations of weevils, which do immense damage to shelled grain stacked in bulk or to cobs from which all the leaves have been taken, when these are stored in godowns. At higher elevations the prevalence of weevils is much less.

The native cultivators, though they do not as a rule pay much attention to the selection of seed, nevetheless preserve it from weevils, by hanging the cobs in bunches under the roofs of their houses ; the smoke which finds its way out through the holes in the roof very effectually keeps these troublesome insects away.

An experiment on the destruction of weevils and beetles may be mentioned here. Weevils had began to attack the seed which had been picked out to plant during and after the rains, viz., various leguminous seeds and some cereals, as wheat, barley, etc. These were put into a bin which had been made airtight ; the lid of the box fits into a small trough about two inches deep, fixed round the top of the bin ; sulphur was ignited and put into the bin and the lid put on. Water was then poured into the groove into which the turned down edges of the lid fit ; the bin was thus rendered thoroughly airtight. The sulphur was left in for an hour, and at the end of that time all insects were killed. The germinating power of the seed did not appear to have suffered in the least.

To make a definite test, on 22nd April 1911, 100 seeds of maize and 100 seeds of *gahat* (the former very liable to attacks of weevils and the latter one of the grains most commonly attacked by beetles) were placed in a tray in the bin together with some weevils and beetles, and sulphur was burnt and left in for an hour On examination after this it was found that all the insects were dead; the seeds were then planted and showed a germinating capacity as follows:—

Maize	...	...	... 99 per cent.
Gahat	...	...	... 89 ,,

Carbon bisulphide is usually recommended for destroying weevils; but while this can only be obtained from chemists, and its use is attended with some risk owing to its inflammability, sulp e can be got in any bazar, and might be used by the native cultivators A kerosine oil tin would make an excellent box for sm ll quantities of seeds: the fumes of sulphur dioxide, though very pungent and injurious, would be quickly dispersed if the fumigating were done in the open air. After weevils have once been destroyed the seed should be kept free from further attack by storing it in boxes where insects cannot find ingress. A simple way of doing this is by plastering the lids and any holes that may be present with cowdung.

Maize was grown on 19·7 acres, of which ten acres were under experimental cultivation. The outturns are here shown:—

	Area.	Weight as carried in with leaves attached.	Weight of grain.	Grain per acre.
	Acres.	Mds. srs.	Mds. srs.	Mds. srs.
Experimental ...	10·0	545 0	298 12	29 33
Non-experimental.	9·7	520 16	246 7	25 15
Total ...	19·7	1,065 16	544 19	27 25

The proportion of grain from the cobs with leaves attached was 51·1 per cent. against 47·3 per cent. last year. The average outturn of

27 maunds 25 seers shows a very large increase over that of 1909-10, viz, 21 maunds 21 seers. The following table shows the result of experimental maize cultivation in 1909-10 and 1910-11 ;—

1909-10.

Area.	Outturn.	Value.	Cost of cultivation.	Profit.
Acres.	Mds. s.	Rs. A. P.	Rs. A. P.	Rs. A. P.
11	280 18	595 12 10	295 15 6	299 13 4
1	25 10	54 2 9	26 14 6	27 4 3

1910-11.

Area.	Outturn.	Value.	Cost of cultivation.	Profit.
Acres.	Mds. srs.	Rs. A. P.	Rs. A. P.	Rs. A. P.
10	298 12	671 2 9	327 5 6	343 13 3
1	29 33	67 1 9	32 11 9	34 6 0

The value is calculated at Rs. 2-2 per maund of grain in 1909-10 and Rs. 2-4 in 1910-11, maize selling better this year than last.

The variety experiment has shown the following results. Fifty maunds manure were applied in 1909-10 and 200 maunds in 1910-11. The plots were an acre each :—

Variety.	Outturn, 1909-10.	Outturn, 1910-11.
	Mds. s.	Mds. s.
Round yellow ...	19 12 (average of two plots).	29 18 (average of two plots).
Flat yellow ...	37 13	34 8
Round white ...	26 32	32 33
Flat white ...	28 8	35 22
Red ...	19 30	30 10

The flat varieties have been the heaviest croppers both years. The figures for the manurial experiments of the last two years are—

	Manure per acre.	Outturn, 1909-10.		Outturn, 1910-11	
		Mds.	s.	Mds.	s.
1.	100 mds. manure, 2 mds. superphosphate.	28	32	29	0
2.	100 mds. manure	27	17	30	36
3.	Unmanured	25	8	27	2

In 1909-10 acre plots were used for this experiment, but for 1910-11 half acre plots were substituted. The above figures are not very definite, and the test should be continued for a number of years before the action of superphosphate on this farm can be definitely shown The unmanured plot gave the poorest outturn both years, and if the experiment is carried out on the same plots the figures may be expected to show much greater differences.

Owing to the late ripening of oats one plot of half an acre could not be planted till 28th April. This is very late, and the following figures are interesting in showing the effect of late planting :—

	Area sown.	Date of sowing.	Outturn per acre.	
	Acres.		Mds.	s.
1.	19·20 ...	14th March to 6th April ...	27	34
2.	·50 ...	28th April	18	38

The late sown plot was considerably better land than the average.

Jaunpur maize has been tried, but has proved a failure. The following figures from an experiment in 1808-09 are reproduced:—

	Jaunpur maize.		Local maize.		
	Mds.	s.	Mds.	s	
Plot No. 1	4	0	27	24	per acre.
„ „ 2	3	32	28	0	„

Detailed particulars of the cultivation of 1 acre of maize are appended:—

Field No. 156, 1 acre. White flat variety.

200 maunds manure per acre.

Date.	Particulars.	Cost. Rs.	A.	P.
1910.				
March 15—17th...	Ploughing (6 teams) ...	3	12	0
„ 15—17th...	Breaking clods with *kodalis* ...	3	10	0
„ 16-17th ...	Carrying and spreading manure, 200 maunds at 9 pies.	9	6	0
„ 23rd ...	Ploughing in seed (2 teams) ..	1	4	0
„ 23rd ...	Sowing seed, breaking clods, digging corners, etc.	0	11	0
„ 23rd ...	Cost of 25 seers seed ...	1	9	0
April 28th ...	Thinning	0	7	0
May 3rd ...	Hoeing and thinning ...	2	10	0
„ 23rd ...	Thinning	0	5	0
June 7-8th ..	Hoeing	4	1	0
August 19th ..	Tying up fallen stalks ...	0	8	0
September 6th ...	Cutting off cobs, carrying in, tying up cobs, stacking and thatching.	5	11	6
November 11th ...	Shelling	0	3	0
1911.				
February 23-24th	Getting off leaves and shelling	2	8	0
	Total ...	36	9	6
	35 maunds 22 seers at Rs. 2-4...	79	15	9
	Profit ...	43	6	3

Oryza Sativa, Rice—*Dhan.*

Rice is not cultivated at elevations very much over 4,000 feet, and as the Demonstration Farm approaches this altitude, the effect of the colder weather, such as was experienced during the growing season of 1910, has a great influence on this crop. The outturn was this year 17 maunds 19 seers per acre as compared with 20 maunds 9 seers in 1909-10.

Sowing took place from 18th May to 5th June in 1909 and from 20th May to 9th June in 1910, while the seedlings were transplanted from 5th July to 2nd August in 1909 and from 11th July to 2nd August in 1910. The crop was cut in 1909 from 5th November to 27th with the exception of one plains variety, Badshabhog, which was cut on 10th December. In 1910 the cutting of the rice crop took place from 8th to 26th November. 10·63 acres of rice were cultivated this year, detailed reports of the whole of which have been registered in the cultivation book. One maund of seed is used per acre, but there are generally a few seedlings to spare. Rice seed-beds are sometimes damaged by floods; and unless plenty of seed is sown there is the chance that it may not prove sufficient. The usual plan is to put several seedlings in each place during transplanting, so that in the coarse varieties of rice, a full maund of seed is often required.

Much less seed would be needed by planting singly, and experiments might be conducted to show the results of this, though the work of transplanting would probably be much slower if one seedling were planted in each place. The following table shows the total and average outturns, cost of cultivation, etc.:—

Area.	Outturn.		Value	Cost of cultivation.	Profit.
	Grain.	Straw.	Grains Rs. 2-8. Straw As. 6.		
	Mds. s.	Mds. s.	Rs. a. p.	Rs. a p.	Rs. a.
10·63 acres	185 33	368 4	602 9 6	449 7 6	153 2
1 acre	17 19	34 24	56 10 6	42 4 6	14 6

The average profit is only about two-thirds that of last year, which was Rs. 21-6-7. The grain is calculated at the same value and the straw at one anna per maund less. The cost of cultivation in 1909-10 was Rs. 46-1-5 per acre against Rs. 42-4-6 this year. Compared with the profit on maize the above sum is very small, and maize is undoubtedly the better paying crop. The cost of cultivating rice this year was about Rs. 10 per acre more than that expended per acre of maize, while the outturn of rice at this elevation would never be so great as that of maize.

Manurial experiment on rice.—The results of this for two years are here given :—

Manure.	1909-10.		1910-11.	
	Outturn per acre.		Outturn per acre.	
	Grain.	Straw.	Grain	Straw.
	Mds. s.	Mds. s.	Mds. s	Mds. s.
Unmanured ..	27 31	43 14	15 36	31 23
50 maunds manure ...	25 0	40 38	15 0	27 18
Green manuring Dhaincha	21 12	23 30	18 24	31 26

In 1909-10 one acre plots were tried with *touli* variety of rice and in 1910-11 one-third acre plots with danase variety.

The figures are certainly not quite what might have been expected. The test will be continued on the same plots as were used for this year's experiment, which are fairly uniform.

Dhaincha makes very poor growth here, and Soy bean has now been substituted for it, the latter plant being a very suitable one for green manurial purposes on hill land.

Variety experiment.—Seven kinds of rice were tried on $\frac{1}{4}$ acre plots, manure at the rate of 50 maunds per acre being applied to each.

The results of two years' experiments are here shown :—

Variety.	1909-10.		1910-11.	
	Outturn per acre.		Outturn per acre.	
	Grain.	Straw.	Grain.	Straw.
	Mds. s.	Mds. s.	Mds. s.	Mds. s.
1. Touli (hill rice) ...	15 38	31 37	22 36	39 12
2. Danase (do.) ...	20 6	39 2	21 24	42 28
3. Krishnabhog (do.) ...	10 0	55 0	18 8	49 4
4. Maharajwa (plain's rice)	14 0	50 0	10 32	41 0
5. Badshabhog (do.)	2 24	61 0	Discontinued	
6. Mansara (hill rice) ...	...	.....	21 24	37 12
7. Rato Marsi (do)	... ..	.....	20 24	40 4
8. Ramtulasi (do.) ...	.....	.....	20 8	47 20

Krishnabhog is a fine variety and much sought after for table rice. It is usually grown at lower elevations than that of this farm. The plains varieties have not done satisfactorily, and require a longer period for ripening than the hill kinds. This militates very much against their success, as there is not sufficient water to properly irrigate them during the later stages. Maharajwa will be discontinued in 1910-11 and the test carried on with six varieties.

The remainder of the rice land was under touli and danase, two of the most generally grown varieties in this district, though touli is perhaps the more popular.

The following table shows the comparative yield of these two varieties and that of three varieties grown in 1909-10 :—

Variety.	1909-10.			1910-11.		
	Area.	Outturn per acre.		Area.	Outturn per acre.	
		Grain.	Straw.		Grain.	Straw.
	Acres.	Mds. s.	Mds. s.	Acres.	Mds. s.	Mds. s.
1. Touli ...	3·18	24 7	35 31	6·09	18 20	32 11
2. Danase ...	3 90	20 25	40 1	3·29	15 11	35 39
3. Mansara ...	2·57	17 39	35 10	...	...	.....

There is a similarity in the comparative outturns of the two varieties—*touli* and *danase*—in both years, and the above figures probably represent very closely their respective values. In every case danase has given a greater weight of straw than the other.

The following table shows the amount of table rice from one maund of dhan of five varieties :—

	Seers.
Touli	28
Danase	27
Mansara	21
Krishnabhog	22
Maharajwa	22

To show details of cultivation and dates of the various operations the following report from the cultivation book is appended:—

Field No. 72, 2·57 acres.

Touli variety (coarse) unmanured.

Date. 1910.	Particulars.	Rs.	A.	P.
May 14th ...	Ploughing seed-bed ...			
June 4th—9th ...	Preparing and sowing seed-bed	3	2	0
	2 maunds 23 seers seed ...	6	7	0
June 11th—18th ...	Ploughing (5 teams per acre)	8	0	6
July 9th—27th ...	Cutting weeds from banks of terraces (*alis*) ...	9	15	0
„ 26th—28th ...	Ploughing in water (4 teams per acre)	6	7	0
„ 26th—28th ...	Building up *alis* ...	5	10	0
„ 28th ...	Mixing soil and water and levelling with dande (2 teams per acre)	3	3	6
„ 28th ...	Levelling with *phauri* (hand leveller) and *kodallies*	3	10	0
„ 26th—27th and 28th.	Getting out seedlings and transplanting ...	11	8	0
September 27th—28th	Hand-weeding ...	16	0	0
November 14th—16th	Cutting	7	15	0
November 19th—21st	Tying up, carrying and stacking.	6	11	0
December 26th—28th	Threshing, winnowing, tying up straw, etc.	7	6	0
	Making and repairing *nalis* and watering for whole period.	8	2	0
		104	1	0

	Mds.	s.	Rs.	A.	Rs.	A.	P.
Grain ...	49	28	at 2	8	124	4	0
Straw ...	79	12	at 0	6	29	11	9
					153	15	9
Profit					49	14	9

ELEUSINE CORACANA—Millet—*Kodo, Marwa.*

This crop is very widely grown in the district, more than three quarters of the maize land being succeeded by this crop. Maize and *kodo* are thus often grown year after year on the same land. The grain is used as a food by the people who also brew a mild drink, *marwa*, from it. *Kodo* is also given to cattle and pigs. The straw is not often cut, except when near a bazar, when it is sold as fodder for mules, etc. The usual practice is to graze cattle and goats over the land after the ears have been plucked Unless the *kodo* seedlings are damaged when very small, it is a fairly sure crop. The cultivation is, however, very expensive ; and unless the land is fairly good the cost is often more than the value of the crop. Transplanting, hand weeding and harvesting (cutting off the ears are very slow processes, while threshing takes a considerable time. *Kodo* was grown this year on 1·14 acres from which the weight of grain amounted to 25 mds. 38 seers per acre compared with 19 mds. 29 seers per acre in 1909-10.

The plot of land under *kodo* in 1910-11 is about the best on the farm, having given the highest yield of maize in two successive years.

Detailed particulars of cultivation of *kodo* are given :—

Field No. 156, 1 acre. Unmanured except seed-bed.

Date. 1910.		Particulars.	Rs.	A.	P.
March 10th—24th	...	Ploughing seed-bed ...	0	7	0
April 28th	...	40 maunds manure to seed-bed.	1	14	0
May 10th	...	Digging and weeding seed-bed and sowing seed.	0	15	0
„ 19th	...	10 seers seed	0	10	0
June 2nd—3rd	...	Weeding seed-bed ...	0	12	0
„ 20th—29th	...	Pulling up and burying weeds, getting out seedlings, and transplanting.	18	11	0
September 7th	...	Cutting and carrying off maize stalks.	1	15	0
„ 15th—16th	...	Hand weeding ...	10	6	6

Date.	Particulars.			Rs.	A.	P.
November 29th—30th December 1st ...	Plucking ears		...	8	14	0
„ 9th—10th ...	Threshing winnowing, etc.			4	0	0
				48	8	6
		Rs. A. P.				
Grain, 26 maunds 9 seers, at Rs. 2·6		62 4 6				
Straw, say	...	4 0 0				
				66	4	6
Profit	...	.....		17	12	0

The straw is put down at Rs. 4 as being approximately its value for grazing purposes. Last year a loss of Rs. 12-10-3 was shown, so that the crop has been very much more successful this year There are several reasons for this. The cost of cultivation was last year Rs. 60-0-6, which is rather high The above sum (Rs. 48-8-6) probably represents about the lowest figure at which a crop of the above yield could be grown. It has already been pointed out that the land was the best on the farm. The price too (Rs. 2-6) a maund is higher than that put down for 1909-10. Altogether it will be seen that the above report shows *kodo* in a very favourable light, and it will not be easy to get much better results than were obtained this year. *Kodo* would not appear to take very much out of the soil, as the crop is grown continuously on the same land.

Corchorus Capsularis—Jute.

The cultivation of this crop has been discontinued, and it was not grown during the year under report.

The outturns obtained in the two previous years were as follows :—

Year.		Outturn per acre. Mds.	s.
1908-09	...	... 5	4
1909-10	...	... 2	8

The quality of the fibre was rather poor, while the cost of cultivation was Rs. 93-12 and Rs. 91-12, respectively, the value of the produce being less than half the expenditure.

Sorghum Vulgare—Great Millet—*Juar*.

This cereal is not grown by the native cultivators of the district as a crop, though a few plants are sometimes seen. It is usually sown in May or June.

Plains *juar* was tried against the local kind in 1907-08 and 1908-09. The local variety was much superior, the other being quite a failure the second year. The yield of grain from the local kind is shown for three years.

Year.	Outturn per acre. Mds. s.
1908-09	... 11 24
1909-10	... 14 0
1910-11	... 10 14
Average for three years ...	... 12 0

This is a very poor yield compared with that of maize. The average cost of cultivation for the three years was Rs. 33-10, which is about Rs. 4 higher than the average expenditure per acre on maize for two years. In the case of *juar*, however, the fact that only small plots were grown tends to make the cost higher than it would be, if larger areas were dealt with. There is no local sale for *juar*. The farm coolies would not take it at Re. 1-14 per maund, preferring maize at Rs. 2-4. Moreover, as *juar* does not ripen till late in December, it is not possible to take another crop from the same ground. The crop will now be discontinued.

Fagopyrum Esculentum—Buckwheat—*Phapar*.

Small areas of this crop are grown locally, but the cultivation is not extensive. It is usually considered an exhausting crop, and when land is let out on the half-crop system, the taking of crops of buckwheat is prohibited.

From my own observation there would appear to be some reason in this, and the following figures bearing on the subject are interesting :—

	1909-10. Mds.	s.	1910-11. Mds.	s.
Average yield of maize per acre on whole area.	21	21	27	25
Yield of maize per acre, a crop of buckwheat being grown after the maize crop of 1909-10.	30	17	31	28

I do not know of any other cause likely to account for the increase of outturn being so much less on the plot on which buckwheat had been grown.

Buckwheat occupies the land only about three months, being sown in September and ripening in December.

The cultivation is simple and inexpensive. The most important peculiarity of buckwheat is its tendency to shed the grains. It ripens unevenly, and if cut early there is some loss, but if left too long there will be a greater loss through the grains falling off during the operation of harvesting. It is usual to cut it and thresh out the grain immediately while the straw is green, the grain being separately dried afterwards. In any case it should be carried to the threshing floor immediately and not kept on the field to dry. The young plants of buckwheat which come up after the crop is taken off from the seeds which have been shed are eaten by the natives as a vegetable.

The outturn of buckwheat per acre was 8 maunds 5 seers compared with 7 maunds 27 seers in 1909-10.

The following extract from the cultivation book shows the dates and cost of the various operations :—

Field No. 154, ·40 acre. Unmanured.

Date. 1910.	Particulars.	Rs.	A.	P.
September 1st ...	Cutting and carrying off maize stalks and cutting jungle	1	12	0
,, 14th ...	Ploughing	0	10	0
,, 15th ...	Sowing and hoeing in seed	1	6	0
	12 seers seed	0	12	0
December 13th ...	Cutting and carrying ...	3	10	0
,, 14th ...	Threshing and winnowing ...			
		8	2	0

	Rs.	A.			
Grain, 4 maunds 13 seers, at Rs. 2-8 ...	10	13			
Straw, 17 ,, say at 1 anna ...	1	1			
			11	14	0
Profit ...			3	12	0

or Rs. 9-6 per acre.

Triticum Sativum—Wheat—*Gehun*.

Wheat is not grown to any extent; small patches are seen here and there, and these are chiefly cultivated by Lepchas or Bhutias, the Nepalese growing very little of this crop.

The crop is a rather uncertain one. It is sown about the end of September or early in October when grown after maize, but if it follows rice it is put in in December.

Muzaffarnagar wheat has been tried against the local variety for two years with results as shown below :—

One acre plots.

Year.	Local wheat.			Muzaffarnagar wheat.		
	Cost of cultivation.	Outturn per acre.		Cost of cultivation	Outturn per acre.	
		Grain.	Straw.		Grain.	Straw.
	Rs. A. P.	Mds. s.	Mds. s.	Rs. A. P.	Mds s.	Mds. s.
1909-10 ...	23 15 6	4 14	9 32	27 13 0	11 0	12 0
1910-11 ...	27 11 0	4 30	14 24	22 11 6	3 14	7 9

The plains variety this year was a thin crop and should ordinarily give a better outturn than the above. The quality of the sample is much superior to the local wheat.

The above experiments were conducted on acre plots. In 1908-09 local wheat gave an outturn of—

			Mds. s.	
Grain	...	...	8 10	per acre.
Straw	...	...	17 0	,,

Very little of the land in the district has any crop on it after December, and one of the disadvantages of growing wheat is that it does not ripen until March and is apt to suffer a good deal of damage from trespass, especially when near the bazar. Pigs especially have been very troublesome at this farm, it not being an easy matter to fence against these animals, while catching them is equally difficult, and unless they are impounded, the owners do not trouble much about them, and are quite ready to deny proprietorship as long as the pigs seem in no great danger of being caught. Mules too in the cold weather are very troublesome, but are more easily dealt with.

Financially wheat has not yet proved a success. The average outturn of the crop from the figures of three successive years is—

	Mds.	s.	
Grain	6	13	per acre.
Straw	12	5	,,

the value of which is about Rs. 22-2 calculating the grain at Rs. 3-6 and the straw at 1 anna, while the cost of cultivation is Rs. 27-1-9, showing a loss of about Rs. 5 per acre.

Hordeum Hexastichum—Barley—*Jau.*

Barley is very little grown, and the general remarks about the cultivation of wheat apply to this crop also.

The following table shows the record of barley for two years—

Year.	Local Barley.			Cawnpore Barley			Remarks.
	Cost of cultivation.	Outturn per acre.		Cost of cultivation.	Outturn per acre.		
		Grain.	Straw.		Grain.	Straw.	
	Rs. a.	Mds. s.	Mds s.	Rs. a.	Mds. s.	Mds. s.	
1909-10 ..	24 12	3 13	6 0	...	...	...	1 acre plot.
1910-11 ...	27 6	11 4	17 12	22 2	1 28	11 0	¼ ,, ,,

It is not proposed to try the Cawnpore variety again at present after the above result. The cultivation of the local kind might be continued on a small area for a year or two. The crop ripens in April, and this year the planting of the maize crop could not be done until 26th April. This is much too late as seen in the note under the heading of maize.

Details of barley cultivation, which is very similar to that of wheat, are given :—

Field No. 162, ¼ acre.

Date.	Particulars.	Rs.	a.	p.
1910.				
September 17th ...	Cutting and carrying off maize stalks and cutting jungle ...	0	10	6
September 22nd ...	Ploughing	0	10	0
October 19—20th	Sowing and hoeing in seed ...	0	14	0
	20 seers seed	1	8	0

Date.	Particulars.			Rs.	A.	P.
1911.						
April 24th	... Cutting and carrying		...	2	7	0
April 28th	.. Threshing and winnowing		...	0	12	0
				6	13	6

	Rs.	A.	P.			
Grain, 2 mds. 31 seers, at Rs. 3	... 8	5	0			
Straw, 4 " " 13 " " A. 1	... 0	4	3			
				8	9	3
Profit			...	1	11	9

or Rs. 6-15 per acre.

Although this yield of local barley shows a fairly good crop and is much superior to the outturns of previous years, the loss entailed owing to the delay in planting the succeeding crop of maize would be very much greater than the profit shown on the crop of barley itself. Altogether it would seem that there is very little encouragement to continue the cultivation of barley.

Triticum Sativum—Spelta—*Uwa.*

Uwa has done very badly and no good purpose would be served by carrying out further experiments with this crop.

The yield in 1909-10 was at the rate of only 1 maund per acre, and in 1910-11 1 maund 16 seers. Since the cultivation is practically the same as that for wheat and barley, a considerable loss is sustained in growing it, the loss being Rs. 18-13-6 per acre as the average of two years.

Avena Sativa—Oats.

This crop is not grown by the natives here. It has been tried at the farm for two years, the outturn being—

	Mds.	s.
1909-10	5	28
1910-11	4	16

The sample this year was very light and of little value. The cultivation of oats will be discontinued.

ORYZA SATIVA—Ghaiya or unirrigated rice.

This crop is sometimes seen, but only on very small areas. It is sown about the same time as maize, or a little later, and ripens soon after that crop.

The usual plan is to dibble the seeds, a few in each place about 8 or 10 inches apart. The cultivation is expensive, and as a rule the Lepchas only go in for growing *ghaiya*.

It was tried at the farm this year on ¼ acre, the outturn being at the rate of—

	Mds.	Srs.	
Grain ...	24	8	per acre.
Straw ...	272	0	

In spite of this large yield a slight loss was this year recorded. The cultivation of this crop should be continued, but it would not be advisable to sow more than a small area.

LEGUMINOSÆ.

The crops belonging to this order which are cultivated in the district are shown in the following table:—

Botanical name.	English name.	Nepalese name.	Number of varieties	REMARKS.
Glycine soja ...	Soy bean ...	Bhatmas ...	6	Lepcha name selliyang.
Phaseolus mungo ...	Dâl	Dal ...	3	
„ radiatus ...	Do. ...	Mungi dâl ...	1	
„ calcaratus ...	.....	Mashyem ...	3	
„ sublobatus ...	.....	Ditto ...	1	This species is often called gurans.
Dolichos biflorus ...	.....	Gahat ...	2	

In addition to those which are grown as field crops there area number of different varieties of vegetable beans.

GLYCINE SOJA. Soy Bean—Bhatmas.

This crop which has recently aroused a great deal of interest is represented in these hills by six varieties as follows:—

A. *Plants of trailing habit, growing 3 to 6 feet in length.*

1. Grain, light green. This is the most popular variety as a food being considered to have the finest flavour, but it is not grown except in small quantities.

2. Grain, chocolate coloured.

3. Grain, black.

Neither of these two (2) and (3) is cultivated separately except on very small plots, but the seeds are usually found mixed in ordinary samples of Bhatmas.

B. *Erect growing varieties 1½ to 2½ feet in height.*

4. Grain, yellowish brown. This is the most common variety and can generally be obtained in the bazar. It is know as Barmeli Bhatmas.

The grains of these four varieties are fairly similar in size.

5. Grain, white and rather bigger. This is not so much grown as No. 4.

6. Grain, chocolate coloured This variety known as Nepali Bhatmas is not much grown. I have never seen it in the bazar and have found difficulty in getting a few seers for seed. The grain is much larger than any of the preceding kinds, is round in shape and rather bigger than the ordinary garden pea.

This kind also differs from the others in the method of cultivation; it requires to be planted considerably earlier, *i.e.*, from April to the beginning of June, and will not grow successfully when sown among maize, as the either kinds usually are. It would not appear to stand shading and requires to be cultivated as a separate crop on open ground. This is a great disadvantage and probably accounts for the fact that it is not commonly grown.

This year a quarter of an acre was cultivated at the Demonstration Farm among maize, and gave very poor results, the yield being only at the rate of about 2½ maunds per acre. Next year it will be grown separately, and better results may be expected.

The usual method of cultivation of the first five varieties is as follows:—After the maize crop has received the second hoeing and the weeds have been carefully buried the seed is sown among it at the rate of half a maund per acre in June or the beginning of July. After the maize has been harvested the top parts of the stalks are cut off and carried away, and the Bhatmas is then hand weeded. The weeds may be pulled up and laid on the ground if the crop is not very thick, but they are often tied on to the maize stalks which have been left standing. After weeding the crop soon covers the ground with a mass of luxuriant vegetation, the appearance of which is very fine. Soy bean ripens in November. The leaves usually fall off before the crop is harvested and add to the manurial residue left by the roots, the nodules of which are very conspicuous.

There is not much local sale for Soy beans. The price is from Rs. 2-8 to over Rs 3 according to the season. The straw of this crop is very coarse, and not much liked by stock when dry. It is useful for bedding and adds to the value of the manure.

Bhatmas will be employed in the manurial experiment for rice, as it is much more suitable here than Dhaincha.

For green manuring purposes for tea or other crops the erect growing varieties will be found the most satisfactory as they do not climb on the tea bushes and are also much more easily dug or ploughed in. No. 4, Barmeli Bhatmas, is probably the best variety, and as this is the one usually grown by the native cultivators seed could easily be obtained. No 6 is said to grow at higher altitudes than the other varieties.

I have had a number of enquiries about Soy bean and have supplied 10 maunds for green manuring purposes to a tea garden in Darjeeling as well as small amounts elsewhere. In addition two consignments were sent to Assam gardens through Dr. Hope, the Scientific Officer of the Tea Association. Samples of four other leguminous crops from this farm were also sent to Dr. Hope for experimental purposes.

The Soy bean is cultivated on the higher elevations up to 6,000 feet where *dâl* will not thrive.

In 1909-10 a small area was sown at the farm, but the crop was rather thin and the yield only at the rate of 5 maunds 13 seers per acre.

During the year under report, in addition to ¼ acre of Nepali Bhatmas and a small patch of the black variety which was sown to provide seed for another year, Barmeli Bhatmas was cultivated on 1·5 acres, and gave the following result:—

Yield per acre.				Value of yield.	Cost of cultivation per acre.	Profit.
Grain.		Straw.				
Mds.	s.	Mds.	s.	Rs a. p.	Rs. a. p.	Rs. a. p.
14	35	17	24	47 9 3	21 4 0	26 5 3

The grain is reckoned at Rs. 3-2 and the straw at 1 anna per maund.

The above figures show this crop to be a very profitable one apart from its manurial value. The best half acre, which gave an outturn of 8 maunds 26 seers, shows a profit at the rate of Rs. 33-1 per acre, which is much the same as the average for the maize crop itself. As a crop to follow maize it is excellent, and its cultivation and use seem to be worthy of extension.

Five varieties of Soy bean will be grown in 1911-12.

Samples of the Kalimpong varieties of Soy bean were sent to the Indian Museum.

The following table shows the percentage of oil contained:—

Number as above.	Museum number.	Variety.	Oil.
3	31,565	Black.	16·50
5	31,566	White.	16·51
2	31,567	Brown.	17·25
1	31,568	Green.	19·52
4	31,569	Yellowish.	16·62

Average percentage of oil 17·28.

Two general analyses of Soy beans are given :—

1. From a paper on the Soy Bean by Mr. Hooper (Agricultural Ledger, 1911, No. 3, reproduced from Church's Food-grains of India).

2. From the Standard Cyclopedia of Modern Agriculture—

Water ...	11·0	10·41
Albuminoids ...	35·3	40·50
Oil ...	18·9	17·47
Carbohydrates ...	26·0	22·38
Fibre ...	4·2	4·21
Ash ...	4·6	5·03
	100·00	100·00

Although varying considerably, both these analyses show the Soy bean to be extremely rich both in oil and albuminoids.

Phaseolous Mungo—*Dâl.*

This legume forms an important crop in the hills at elevations below 4,000 feet and there is a considerable bazar trade in the grain. There are three varieties cultivated locally, the most important being the yellow one; but this is frequently mixed with two black varieties, one having a smooth shining skin, and the other being rougher in appearance and of a dull black colour. The two latter kinds are also grown separately to some extent. The price of *dâl* varies from about Rs. 2-12 to Rs. 3-12 per maund.

In 1910-11 2·62 acres were under this crop. The yield was not very good and considerably less than in 1909-10, as shown by the following figures :—

	Area sown.	Yield per acre. Grain.		Yield per acre. Straw.	
	Acres.	Mds.	s.	Mds.	s.
1909-10 ...	1	7	28	8	20
1910-11 ...	2·62	6	0	6	9

The cost of cultivation in 1910-11 amounted to Rs. 22-7-6 per acre, while the value of produce may be put down as Rs. 21-6-3, thus showing a slight loss on the crop. The process of hand-weeding is a slow one, as is also the preliminary one of pulling up the weeds and burying them before sowing the seed.

The yield of *dâl* gets higher as the valleys are approached, the farm being rather high for this crop. The outturn, however, may be expected to show better results than were obtained this year.

Dâl was planted on the *alis* or raised banks of the rice terraces by dibbling in a few seeds about a feet apart. This is a common practice in the district, and enables the *alis*, which could otherwise not be utilized, to add to the produce yielded by the rice terraces. Soy bean is also used for this purpose. About 2 seers of seed were used per acre and the produce amounted to 30 seers.

PHASEOLUS RADIATUS—*Mūngi dâl.*

The cultivation of this crop is similar to that for *dâl.* ·38 acre was planted in 1910-11 and gave an outturn of 6 maunds 7 seers per acre. *Mūngi dâl* is not extensively grown; the price is rather higher than that of ordinary dal. The grain is a small one and green in colour.

PHASEOLUS CALCARATUS—*Mashyem.*

Mashyem is grown locally to some extent, though there is little trade in this grain.

The three varieties are equal in size, but vary in colour, being red, mottled gray and yellowish white.

Particulars of the cultivation of Mashyem, which is typical of the legumes of the district, are here given:—

Field No. 113 1 acre.

Date.	Particulars.	Rs.	A.	P.
1910.				
August 5th, 6th, 8th.	Pulling up weeds from among maize and burying ...	4	14	6
„ 8th ...	Sowing and hoeing in seed ...	2	3	0
	9 seers seed	0	13	6
September 10th ...	Cutting and carrying off maize stalks	1	9	0
„ 30th ...	Hand weeding	6	0	6
Nov. 19th, 21st ...	Harvesting	3	7	0
„ 28th, 30th...	Threshing and winnowing ...	1	7	0
		20	6	6
Grain, 8 maunds 26 seers at Rs. 2-6 ...	21 10 0			
Straw, 10 „ 18 „ at As. 1 ...	0 10 6			
		22	4	6
	Profit ...	1	14	0

PHASEOLUS SUBLOBATUS—*Mashyem—Gurans.*

This crop is cultivated in a similar manner to the preceding one. ·22 acre was under gurans this year. The outturn was a very good one, viz.—

	Mds.	srs.	
Grain	12	11	per acre.
Straw	9	3	

The grain is much smaller than that of Phaseolus Calcaratus and is red in colour.

Mashyem will do at higher elevation than *dâl*, but not so high as Soy Beans.

DOLICHOS BIFLORUS—*Gahat.*

Gahat is only grown on very small areas. The plant is climbing in habit, growing 4 or 5 feet high. There is not much sale for the grain which is very subject with mūngi dal and gurans to damage by beetles. Gahat was grown on ·20 acre. The crop was too thin and only gave an outturn at the rate of:—

	Mds.	srs.	
Grain	4	12	per acre.
Straw	4	19	

CICER ARIETENUM.—*Gram.*

Gram has been cultivated on the farm for two years with very poor results. It is a plains crop and does not appear to be at all suited to the colder climate of the hills. The yield after rice in 1909-10 was only 32 seers per acre and after maize this year 24 seers.

It is not grown by the native cultivators, and much better work can be done by growing the indigenous legumes than by continuing the cultivation of this crop.

SACCHARUM OFFICINARUM.—*Sugarcane.*

Sugarcane is not grown extensively though small patches of the crop are frequently seen. Most of the produce is sold in the bazars for chewing, some little *ghur*, however, being manufactured.

A small plot $\frac{1}{15}$th acre in extent was planted in April 1909, but the crop here only gives a yield the second year.

The produce was sold from November 1910 to February 1911 for chewing purposes, and realized Rs. 44-15, the weight of canes being 92 maunds 33 seers.

The sale of chewing canes is limited, but the outturn which works out to 618 maunds 33 seers per acre seems to be a fairly good one, and further work with this crop for the manufacture of *ghur* should give useful and valuable information.

Fruit.

One hundred and fifty-eight English fruit trees were ordered by the Hon'ble Mr. Oldham, when Director of Agriculture from Messrs. Bunyard and Company, of Maidstone, Kent. The trees arrived on 31st December 1907 and were put into a nursery, which was shaded to gradually accustom the plants to the strong sunshine.

The larger kinds were planted out during the following monsoon and the remainder were moved in June 1909.

The following table gives under the various headings the number of trees received and those living on 30th June 1911 :—

Names of trees.	Number imported.	Number living on 30th June 1911.
Apples	12	5
Apricots	12	2
Nectarines	6	1
Plums	24	6
Cherries	18	7
Peaches	6	...
Pears	18	3
Walnuts	6	6
Figs	6	1
Vines	6	3
Gooseberries	12	...
Currants	12	...
Raspberries	20	...
	158	34

This is not very encouraging, but the climate is quite unsuitable for some of the kinds.

Three cherry grafts were made on the local Cherry stock and two of these appeared to be growing very well but unfortunately one was broken by the wind and the other by accident. They, however,

looked very promising and a number will be grafted next season. The local cherry trees are very quick growing and bear fruit in profusion, but it is very small and practically tasteless. Grafts on these stocks should prove a success.

Twelve Australian navel orange trees were ordered from Messrs. E. and W. Hackett of Adelaide through Dr. C. H. S. Hope, late Honorary Medical Officer to the Homes. The trees arrived in April 1911 in very good condition and were planted in a shaded nursery and moved into permanent places on 18th May. The navel orange is a very large seedless one and should prove a great acquisition to the district. if it is able to suit itself to the different climatic conditions obtaining here.

The local variety of orange is a source of considerable wealth, large quantities being exported to the plains during the cold season. Propagation of oranges is either by seed or by *gootics*. The latter are made in April by taking off a ring of bark from a small young branch of a tree and tying it up with soil and cowdung and on outer covering of moss which is tied round the branch where the bark has been removed. The roots develop and the branch can be removed during the monsoon and planted out. Propagation by this method is the most common one and the trees quickly come into bearing, but the life of the tree is considered to be much shorter than that of trees grown from seed. The orange season of 1910-11 was a good one. From the farm 13,836 oranges were sold for Rs. 38-14-3, or As. 4-6 per 100.

Papayas, limes, bananas, plums, pears and peaches are also cultivated.

Pineapples also do very well, though generally the bazar ones are very poor in flavour.

Suckers of the "Queen" pine were obtained from the Kalimpong Government gardens in August 1908 and planted on ·15 acre. The produce from this crop in 1909 was only 36 pines, valued at Rs. 2-4, while 340 pines were sold from the plot in 1910 for Rs. 45-1-6.

The quality of the "Queen" is very good and the pines are sweet and juicy attaining quite a good size (up to 3½ lbs. each at the farm). As suckers are distributed to the cultivators from the Government fruit gardens it may be expected that this pine will take the place of the very inferior ones generally seen.

Accounts.—A copy of the balance sheet for the year ending 31st March 1911 is appended—

RECEIPTS.

	Rs. A. P.	Rs. A.
To Government grant... ...		5,000 0
,, sale of kodo ...	197 15 0	
,, ,, rice straw ...	162 12 0	
To ,, dâl ...	7 13 6	
,, ,, linseed ...	3 3 0	
,, ,, rice ...	586 13 3	
,, ,, buckwheat...	51 12 0	
,, ,, juar ...	7 5 6	
,, ,, wheat ...	73 15 6	
,, ,, fruit ...	102 7 3	
,, ,, bamboos ...	16 8 0	
,, ,, bhatmas ...	16 10 6	
,, ,, maize ...	1,260 4 0	
,, ,, kram ...	1 0 0	
,, ,, barley ...	7 8 0	
,, ,, uwa ...	1 11 0	
,, ,, khaiya ...	12 15 0	
,, ,, sugarcane ...	59 5 6	
,, ,, khar ...	9 8 0	
		2,579 7
,, hire of bullocks ...	...	86 8
,, trespassing fees ...	...	19 8
,, miscellaneous receipts	...	8 2
,, rent of farm paid by Homes		70 1
Total ...		7,763 10

EXPENDITURE.

			Rs. A. P.
By debit balance from 1909-10. ...			285 13 9
,, monthly wages ...	853 2 6		
,, weekly wages ...	1,306 4 0		
,, Superintendent ...	3,437 8 0		
,, establishment ...		...	5,597 8 6
,, implements, tools, etc.		...	134 6 6
,, seeds		...	28 10 3
,, stationery ...		...	7 8 0
,, manures ...		...	22 0 3
,, sundry expenses and postages.		...	35 14 0
,, railway freight and carriage.		...	12 2 3
,, Value of half produce paid to the Homes.		...	1,289 11 6
,, rent of farm ...		...	70 1 0
By balance in hand ...			279 14 0
			7,763 10 0

The value of the total produce sold, viz. Rs. 2,579-7, shows a considerable increase over that of 1909-10, which amounted to Rs. 1,642-12, while the wages bill for monthly and daily labour shows a decrease of Rs. 102-8-6 from the wages bill of 1909-10.

Valuation.—We are again indebted to Mr. A. Dennis Hickley of Gangtok for his kindness is coming over to value the farm stock. A copy of his valuation of the stock as on March 31st 1911 is given :—

	Rs. A.	Rs. A.
Implements	...	710 13
10 Bullocks	...	260 0
Maize	62 7	
Rice	541 4	
Do. straw	5 10	
Kodo	135 12	
Buckwheat	17 8	
Wheat	26 5	
Barley (growing) ...	5 0	
Uwa	1 0	
Dâl	77 10	
Mungi dâl	14 11	

	Rs.	A.	Rs.	A.
Bhatmas	61	1		
Mashyem	21	10		
Gahat	3	8		
Juar	2	0		
Oats (growing)	2	0		
Gram	1	0		
Tori	1	0		
Ghaiya	0	10		
Gurans	6	12		
Nepali Bhatmas ...	2	0		
			988	12
			1,959	9

A. Dennis Hickley,

The 8th April 1911.

The valuation of stock in 1909-10 amounted to Rs. 1,974-13, so that there is a slight decrease this year.

Management.—The Demonstration Farm land was bought by Dr. Graham for the St. Andrew's Colonial Homes and is subject to an annual ground rent of Rs. 70-1. The Agricultural Department gives a yearly grant of Rs. 5,000 to help in carrying on the work. Half of the produce sold is paid to the Homes, the remainder going to the working of the Farm. During the year 1910-11 (July to June) Mr. Buchan, Director of Agriculture, Bengal, inspected the farm on May 11th 1910, while Mr. Smith, Deputy Director, made two inspections, viz.. on 5th to 9th October 1910 and on 10th to 12th March 1911.

I would like here to make some mention of the very good work done by the Farm Sirdar Bishnu Lal who has been on the farm since its commencement. He has practically no knowledge of English, but was for a time at Saharanpur gardens and possesses an intimate knowledge of the farming in the district. He takes a very great interest in the work, and his assistance has been an invaluable asset in the conduct of the farm.

General.—In concluding the report I would like to say a few words in recommendation of the continuation of the Government grant

of Rs. 5,000 per annum after the expiry of the term of five years for which it was originally granted, which will terminate on 31st March 1912. I think it will be agreed that the establishment of an experimental farm entirely under Government control would necessitate a very much larger outlay without the corresponding benfits. The initial sum required to begin a farm would be a large one, and very little real experimental work could be done during the first year or two. As has been previously remarked Kalimpong is eminently suitable for the carrying on of the work, there being in the immediate neighbourhood a greater number of cultivators, owing chiefly to absence of forest, than in any other centre in this part of the Himalayas. The need for reliable information respecting the agricultural produce of the hills, gained from practical experience in the cultivation of the crops is very apparent. Many books on Indian Agriculture devote some space to the consideration of hill farming, but in many cases the information is meagre and at times quite misleading. This is especially the case with the prices given for various parts of the cultivation of different crops and other practical matters.

The Demonstration Farm has now been in progress for four years and is gradually becoming more suitable for correct experimental work. Results varying from those given in this report will doubtless be obtained and are to be expected, and the continuation of work on the various crops is very necessary. It is only by prolonged experiments that average results can be published, and each year's work, though perhaps not adding much to the knowledge of any particular crop, nevertheless confirms previous conclusions. In beginning experimental work in a new district the most important thing is to become familiar with the indigenous crops and their cultivation very thoroughly, and then to try and improve on the methods, and work with introduced crops that show promise of success. Improvements cannot be carried out by one unfamiliar with the details of that he wishes to improve, and experience with the natural products of a district will be found the best education for one who would cultivate an introduced plant through the trial stages until he is able to recommend it as something which will prove a benefit and source of wealth to the district.

PERCY W. GOODWIN, F.A.S.I., M.A.A.C.

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